

CLAIMS

The invention claimed is:

1. A method of etching silicon nitride substantially selectively relative to an oxide of at least one of silicon and aluminum, comprising:
providing a substrate comprising silicon nitride and an oxide of aluminum; and
exposing the silicon nitride and the oxide to an etching solution comprising HF and an organic HF solvent under conditions effective to etch the silicon nitride substantially selectively relative to the oxide.
2. The method of claim 1 comprising providing the substrate to comprise an oxide of silicon and an oxide of aluminum, with the exposing being effective to etch the silicon nitride substantially selectively relative to each of said oxides.
3. The method of claim 1 wherein the organic HF solvent comprises an alcohol.
4. The method of claim 3 wherein the alcohol is aliphatic.
5. The method of claim 3 wherein the alcohol is at least one selected from the group consisting of alicyclic, aromatic, and heterocyclic.

6. The method of claim 3 wherein the organic HF solvent comprises ethanol.

7. The method of claim 1 wherein the organic HF solvent comprises a polyol.

8. The method of claim 7 wherein the polyol has a boiling point of at least 150°C.

9. The method of claim 7 wherein the polyol comprises a glycol.

10. The method of claim 7 wherein the polyol comprises a glycerol.

11. The method of claim 7 wherein the polyol comprises a carboxylic acid.

12. The method of claim 1 wherein the etching solution comprises from 0.1% to 50% by weight water.

13. The method of claim 1 wherein the etching solution comprises from 0.1% to 15% by weight water.

14. The method of claim 1 wherein the etching solution comprises from 0.1% to 5% by weight water.

15. The method of claim 1 wherein the etching solution comprises from 0.1% to 1.0% by weight water.

16. The method of claim 1 wherein the etching solution has from 0% to less than 0.1% by weight water.

17. The method of claim 1 wherein the etching solution comprises from 0.01% to 50% by weight HF.

18. The method of claim 1 wherein the etching solution comprises from 0.1% to 15% by weight HF.

19. The method of claim 1 wherein the etching solution comprises from 1% to 5% by weight HF.

20. The method of claim 1 wherein the etching solution consists essentially of from 0.01% to 50% by weight HF, organic HF solvent, and from 0.1% to 50% by weight water.

21. The method of claim 1 wherein the etching solution consists essentially of from 0.1% to 15% by weight HF, organic HF solvent, and from 0.1% to 10% by weight water.

22. The method of claim 1 wherein the etching solution consists essentially of HF and organic HF solvent.

23. The method of claim 1 wherein the conditions comprise a temperature of at least 60°C.

24. The method of claim 1 wherein the conditions comprise a temperature of from 70°C to 90°C.

25. A method of etching silicon nitride substantially selectively relative to aluminum oxide, comprising:

providing a substrate comprising silicon nitride and a densified aluminum oxide; and

exposing the silicon nitride and the densified aluminum oxide to an etching solution comprising HF and an organic HF solvent under conditions effective to etch the silicon nitride substantially selectively relative to the densified aluminum oxide.

26. The method of claim 25 wherein the organic HF solvent comprises an alcohol.

27. The method of claim 26 wherein the alcohol is aliphatic.

28. The method of claim 26 wherein the alcohol is at least one selected from the group consisting of alicyclic, aromatic, and heterocyclic.

29. The method of claim 26 wherein the organic HF solvent comprises ethanol.

30. The method of claim 25 wherein the organic HF solvent comprises a polyol.

31. The method of claim 30 wherein the polyol has a boiling point of at least 150°C.

32. The method of claim 30 wherein the polyol comprises a glycol.

33. The method of claim 30 wherein the polyol comprises a glycerol.

34. The method of claim 30 wherein the polyol comprises a carboxylic acid.

35. The method of claim 25 wherein the etching solution comprises from 0.1% to 50% by weight water.

36. The method of claim 25 wherein the etching solution comprises from 0.1% to 15% by weight water.

37. The method of claim 25 wherein the etching solution comprises from 0.1% to 5% by weight water.

38. The method of claim 25 wherein the etching solution comprises no more than 1% by weight water.

39. The method of claim 25 wherein the etching solution has from 0% to less than 0.1% by weight water.

40. The method of claim 25 wherein the etching solution comprises from 0.01% to 50% by weight HF.

41. The method of claim 25 wherein the etching solution comprises from 0.1% to 15% by weight HF.

42. The method of claim 25 wherein the etching solution comprises from 1% to 5% by weight HF.

43. The method of claim 25 wherein the etching solution consists essentially of from 0.01% to 50% by weight HF, organic HF solvent, and from 0.1% to 50% by weight water.

44. The method of claim 25 wherein the etching solution consists essentially of from 0.1% to 15% by weight HF, organic HF solvent, and from 0.1% to 10% by weight water.

45. The method of claim 25 wherein the etching solution consists essentially of HF and organic HF solvent.

46. The method of claim 25 wherein the conditions comprise a temperature of at least 60°C.

47. The method of claim 25 wherein the conditions comprise a temperature of from 70°C to 90°C.

48. A method of forming trench isolation within a semiconductor substrate, comprising:

forming a silicon nitride comprising layer over a semiconductor substrate;

etching a series of isolation trenches within the semiconductor substrate using a portion of the silicon nitride comprising layer as a mask;

after etching the isolation trenches, depositing an aluminum oxide comprising layer over tops and sidewalls of the silicon nitride comprising mask and to within the isolation trenches to less than fill the isolation trenches;

after depositing the aluminum oxide, filling remaining volume of the trenches with isolation material;

after the filling, removing the isolation material effective to expose the silicon nitride comprising mask; and

after the exposing, etching the silicon nitride comprising mask with an etching solution comprising HF and an organic HF solvent under conditions effective to etch the silicon nitride comprising mask substantially selectively relative to the aluminum oxide and relative to the isolation material.

49. The method of claim 48 wherein the isolation material comprises silicon dioxide.

50. The method of claim 48 comprising exposing the deposited aluminum oxide to a temperature of at least 500°C for at least 30 seconds prior to the etching.